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CLAIMS

What is claimed is

1. A thermal interface material, comprising:
a phase change polymer; and
a fusible filler material.

2. The material of claim 1, further comprising a non-phase change polymer.

3. The material of claim 1, wherein the phase change polymer is a liquid above 45°C.

4. The material of claim 1, further comprising a non-fusible particle filler.

5. The material of claim 1, wherein the fusible filler is a solder.

6. The material of claim 5, wherein the solder is added to the thermal interface material as a powder.

7. The material of claim 1, wherein a non-fusible mesh is placed within the phase change polymer.

8. The material of claim 4, wherein the thermal conductivity of the non-fusible particle filler is greater than the thermal conductivity of the fusible filler.

9. The material of claim 4, wherein the non-fusible particle filler is selected from the group consisting of glass fiber, graphite fibers, carbon fibers, boron nitride. aluminum oxides, zinc oxide, aluminum, boron nitride, silver, graphite, carbon fibers, diamond, metal coated carbon fiber, and metal coated diamond.

10. The material of claim 1, wherein the fusible filler is a metal alloy.

11. The material of claim 1, wherein the fusible filler is in the range of approximately 10 - 90 by weight of the thermal interface material.

12. The material of claim 1, wherein the fusible filler is in the range of approximately 60 – 90 % by weight of the total weight of the thermal interface material.

13. The material of claim 4, wherein the total filler added for fusible filler and non-fusible particle filler is in the range of approximately 50 – 99% by weight of the total weight of the thermal interface material.

14. The material of claim 13, wherein the non-fusible filler is in the range of approximately 5 - 49% by weight of the total weight of the thermal interface material.

15. The material of claim 4, wherein the fusible filler has a melting temperature approximately between 100 - 250º C.

16. The material of claim 1, wherein the fusible filler is selected from the group consisting of In, InBi, InSn, BiSn, PbSn, SnAg, InPbAg, InAg, InSnBi, InGa SnBiZn, SnInAg, SnAgCu and InPb

17. The material of claim 4, wherein choice of the non-fusible particle filler is excluded from the group consisting of lead, cadmium, mercury, antimony and arsenic.

18. A thermal interface material, comprising:
a phase change polymer binder;
a non-fusible particle filler; and
a fusible filler.

19. The material of claim 18, wherein the non-fusible particle filler is selected from the group consisting of metal, glass fiber, graphite fibers, carbon fibers, and boron nitride.

20. The material of claim 18, wherein choice of fusible filler is excluded from the group consisting of lead, cadmium, mercury, antimony, and arsenic.

21. An assembly, comprising:
a heat sink;
a first thermal interface material; and
a die; wherein the first thermal interface material is a phase change polymer containing a fusible filler and a non-fusible particle filler.

22. The assembly of claim 21, further comprising a spreader plate wherein the first thermal interface material is in between the die and the spreader plate, with a second thermal interface material in between the spreader plate and the heat sink;

and the second thermal interface material is a phase change polymer containing a fusible filler and a non-fusible particle filler.

23. A method for thermally connecting components, comprising:

obtaining a die capable of generating heat;

placing a thermal interface material onto a surface of the die where the thermal interface material is made of a phase change material, a fusible solder, and a non-fusible material;

placing a heat sink on the opposite side of the thermal interface material;

compressing the heat sink, the thermal interface material, and the die together; and

running the die, the thermal interface material, and the heat sink through a reflow operation until the fusible solder becomes liquid.

24. The method of claim 23 wherein a spreader plate is placed between the thermal interface material and the heat sink and a second thermal interface material is placed between the spreader plate and the heat sink.

25. A method of removing heat, comprising:

obtaining a first thermal interface material made of a phase change material and a fusible solder;

placing the thermal interface material against a surface of a die;

positioning a heat sink against the opposite surface of the first thermal interface material;

creating column structures of fusible solder by running the die, the first thermal interface material, and the heat sink through a reflow operation until the fusible solder becomes liquid;

electrically connecting the die to a printed circuit board;

generating heat by the operation of the die; and

removing the heat by conduction from the die, though the first thermal interface material, to the heat sink.

26. The method of claim 25, further comprising:

placing a heat spreader between the thermal interface material and the heat sink,

placing a second thermal interface material between the spreader plate and the heat sink, wherein the second thermal interface material has a phase change material and a fusible solder; and

removing the heat by conduction from the die, though the first thermal interface material, the spreader plate, the second thermal interface material, and into the heat sink.

27. The method of claim 25, wherein the first thermal interface material has a non-fusible material.

28. The method of claim 26, wherein the second thermal interface material has a non-fusible material.